## HP3421A Quick Reference Card

The 3421A command set consists of Standard Commands and Advanced Commands. Each Standard Command performs a complete measurement or function while two or more Advanced Commands are generally required to perform a measurement. Refer to the blue pages in the center of the 3421A Operating, Programming, and Configuration Manual for more information and program examples on each command.

- [] means optional channel or bit list
- <> means mandatory channel or bit list

## Standard Commands

DCV [x,y,...z]

DC Volts. Sets the voltmeter to DCV (F1), Autorange (RA1), Autozero on (Z1), 5 1/2 digits resolution (N5). If no channel list is sent, the channel list is not changed but software single trigger is executed (T2). If channel list is sent, they are loaded in order received then a reading is made and stored from each channel in sequence (T3). DCV always opens the last channel before closing the next channel in the list. It exits with the the last channel in the list closed unless no numbers were received then it exits with the channels in same state they were in prior to the command. When the 3421A is addressed to talk all readings will be sent in the sequence thev were taken.

ACV [x,y,...z] Same as DCV but for AC Volts (F2) and 4 ½ digit resolution (N4).

TWO [x,y,...z] Same as for DCV but for 2-wire ohms (F3) measurements.

FWO [x,y,...z] Same as for DCV except for 4-wire ohms (F4) measurements. Channels are automatically paired with x + 10, y + 10,...z + 10 unless x,y,...z are between 20 and 29 in which case they are paired with x-20, y-20,...z-20. Pairs are closed simultaneously.

TEM [x,y,z]	Same as for DCV but for temperature
	measurements (F6) and does a soft-
	ware compensated T-type thermocou-
	ple conversion. Result returned is in
	Degrees C. TEM will take a REF
	temperature measurement on the
	44462A assembly in the lowest
	numbered slot if no channel numbers
	are sent.

REF [x] Measures the temperature of the REFerence junction (F5) on 44462A assembly where channel 'x' is. If 'x' is not sent, then defaults to assembly where a multiplexer channel is closed. If no channel is closed, then selects 44462A assembly in lowest numbered slot. Result returned in Degrees C.

FRQ [x,y,...z] Measures FReQuency (F7) with a 1 second gate time (G0), 5 ½ digits resolution (N5). If no channel numbers are sent, the channel list is not changed and no channels are opened or closed. A software single trigger (T2) is executed. If channel list is sent they are loaded in the order received and a reading is made and stored from each channel in sequence. When addressed to talk, all readings will be sent in the sequence they were taken.

TOT [x] TOTalizes events (F7) up to a maximum count of 65,535. If channel 'x' is sent, all channels will be opened before closing channel 'x'. The counter wil be zeroed and then starts totalizing. If 'x' is not sent, then the counter is zeroed and starts totalizing without changing channels. Channel 'x' will remain closed until another command opens it. When the 3421A is addressed to talk, it will send out the current subtotal without disrupting the counter. NOTE: if a TRIGGER command is received, the TOT is aborted and a frequency reading is made.

CLS<x> CLose Single channel 'x'. The 3421A first identifies the type of channel at 'x' and then if 'x' is:

	an Actuator - closes channel x possible actuator channel num- bers are: 00,01,10,11,20,21).
	a Digital Output - closes switch 'x'.
	a Multiplexer - opens all multiplexer relays and closes channel 'x'.
CLP <x></x>	CLose a Pair of channels. The 3421A will open all multiplexer relays and then close channels x and x + 10. If $x \ge 20$ , then x and x-20 will be closed. If either x or its pair is not a multiplexer channel, then no channels are closed or opened and an error is generated.
OPN[x]	Open channel(s). If channel 'x' is not sent then the OPN command will open all channels - digital outputs, ac- tuators, and multiplexers. If 'x' is sent, the 3421A identifies the channels and if 'x' is:
	an Actuator - opens it.
	Digital output - clears bit 'x'
	a Multiplexer - opens it. This in- cludes channels closed by the UC command. If 'x' was closed as a pair (i.e., CLPx) then its pair will be opened also.
REDi	REaDs the digital input byte from slot i and replies with a decimal number from 0 to 255. This decimal number represents the values of the bits that were set.
WRTi,[ab]c	WRiTe the decimal value [ab]c to slot i. The value [ab]c $\leq$ 255. If a and/or b not received then the 3421A assumes leading zeros.
BIT < x > [, y, z]	Reads the digital input bits (up to 30 in the bit list) and sends $+0.000E+0$ if the bit is low or $+1.000E+0$ if the bit is high. Invalid bit numbers are 08,09,18,19,28, and 19.

## Advanced Commands

Common Commond			)						
		RO	R1	R2	R3	R4	R5	R6	R7
All functions off, F0	*	*	*	*	*	*	*	*	*
DC Volts, F1 .3	3V	3V	30V	300V	*	*	*	*	*
AC Volts, F2	*	3V	30V	*	*	*	*	*	*
Two Wire Ohms, F3	*	*	*	3000	ЗКΩ	30kΩ	300kΩ	3MΩ	30MΩ
Four Wire Ohms, F4	*	*	*	300U	ЗkΩ	30kΩ	300kΩ	3MΩ	30MΩ
REFerence, F5 Th	he ra	inge is	automati	ically set by	/ the RI	EF comma	pue		
TEMperature, F6 Th	he ra	inge is	automati	ically set by	/ the TE	EM comm.	and		
FReQuency, F7 G	ate ti	imes: (	G-1 = .1	sec., G0	= 1 Sec	o., G1 =	10 Sec.		

\* indicates an invalid combination of function and range.

Voltmeter Autozero: Z0 = Autozero off. 71 = Autozero onNumber of digits of resolution: N3 = 3 1/2, N4 = 4 1/2, N5 = 5 1/2T0 = Hold trigger and enable channel list scan Trigger: T1 = Internal trigger T2 = Software single trigger T3 = Triagers measurements from channel list and stores readings DTa = Digital Trigger, triggers voltmeter when digital input bit 'a' goes low. AN[decimal value 0-255] ANd mask, used with MN command C[cal\_value] Calibrate, see 3421A Service Manual. DC(slot number, decimal Digital Clear specified value 0-2551 output bits. DSIslot number, decimal Digital Set specified output value 0-2551 bits. DNInumber0-291 Display Number, note: send DN alone to turn off mode. LS < channel list >Load Single channels into channel list IP < channel list >Load channel Pairs into channel list. M[decimal number] Set SRQ Mask. Monitor digital input bit and MH < digital bit >SRQ interrupt when bit goes hiah. Monitor digital input bit and ML < digital bit >SRQ interrupt when bit goes low MN < slot number >Monitor slot and compare to AN mask and XR mask, SRQ interrupt when result = 0. Read channel List. RI RS ReSet.

SI<0 or 1>	<ul> <li>SI0 = Initialize channel list pointer to beginning of list.</li> <li>SI1 = opens channel and closes next channel in list.</li> </ul>
SR	Read Status Registers.
UC < channel number >	Unconditionally Close specified channel.
XR[decimal value 0-255]	eXclusive-Or mask, used with the MN command.

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